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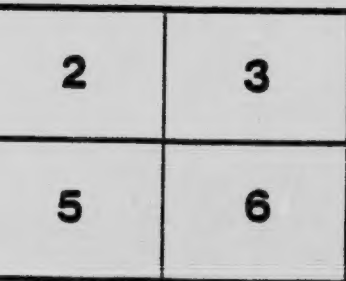
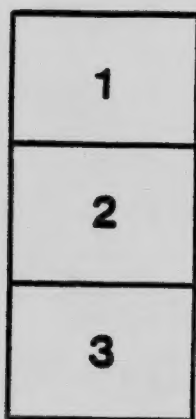
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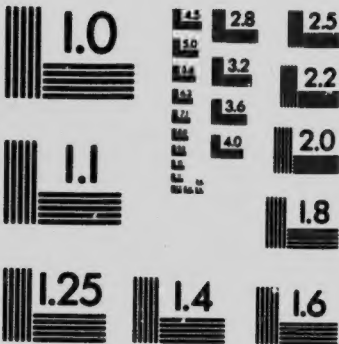
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Seed Grain, Seed Treatment and Seeding

FIELD HUSBANDRY CIRCULAR No. 2

(Revised May, 1919)

BY

JOHN BRACKEN

*Professor of Field Husbandry, College of Agriculture
University of Saskatchewan.*

RECEIVED

SEP 18 1919

INT. AGR. INST.

Nearly twenty million bushels of seed will be sown this spring on Saskatchewan farms, and the yield and quality of the crop will depend in a large measure upon the character of the grain used.

The characteristics of productive seed of any variety are *high quality and high purity*. By high quality is meant freedom from damage from frost, bin burning, sprouting, weathering, rust and immaturity, and absence of shrunken and broken kernels. By high purity is meant freedom from weed seeds, disease, other classes of grain and other varieties of grain.

SOME COMMON DEFECTS IN SEED.

The most common defects found in seed grain are:

- (1) Weed seeds.
- (2) Disease.
- (3) Small and shrunken seeds, or seed of weakened vitality.
- (4) Dead grains.
- (5) Unsuitable varieties.

The weed seeds most often found in wheat, oats and barley are wild oats, cockle, wild buckwheat, and ball mustard, but in poorly cleaned or uncleaned samples many others may be found. In flax, blue burr, hare's ear mustard, common mustard and false flax are the most common impurities.

Samples of seed wheat containing 2,880 wild oats per bushel, of seed oats containing 13,000 wild oats, and of seed flax containing over 30,000 weed seeds of seven different species per bushel, have been brought to our attention.

From these observations it is very apparent that all of us should examine very carefully the seed that we are about to sow. Some of the impurities mentioned cannot easily be removed from oats or barley or flax, but practically all can be taken out of wheat and most can be taken out of any seed by careful cleaning.

The smut diseases cause much loss annually to western farmers. These fungus plants not only lower the yield of crops, but the quality as well. If living smut spores (which function as seeds) are sown with the seed, the crop is sure to be infected.

Small shrunken or weak seed produces weak plants that are less productive and much less likely to withstand spring frosts after the plants are up. This is where the chief danger lies in using grain from a rusted crop.

Dead Grains Produce no Crop.—Frost often kills the seed of the oat crop, while heating often destroys the vitality of wheat and other grain. It is always wise

to test the seed for both percentage and vigor of germination. This is particularly advisable after a season when early fall frosts have been known to occur as well, as in cases where dampness or heating in the bin have been suspected.

Unsuitable Varieties.—A very small proportion of the Saskatchewan crop is grown from unsuitable varieties. Yet there are still many persons using inferior sorts where better paying ones might be grown.

THE BEST VARIETIES TO GROW

The following are the best available varieties for Saskatchewan conditions:—

WHEAT—Red Fife—High in quality, long straw, late in maturing, a good yielder. It is suited to the lighter and earlier types of soil, to the drier parts of the province, to all regions where fall frosts are not feared, and where long straw is desired.

Marquis—High in quality, short straw, early in maturing, non-shattering, good yielder. This variety is likely to give more satisfactory returns than Red Fife on heavy soils, on fallowed land, in moist regions, where fall frosts are feared and in those areas where a short straw is preferred.

Pioneer—High in quality, long and weak straw, earlier than Marquis, fair yield. It is a good wheat for all regions where Marquis is not early enough and where the crop seldom lodges.

Prelude—High in quality of gluten but only fair in color of flour, short straw, earlier than Pioneer, bearded, shatters easily, low in yield. This variety may be found satisfactory in regions north of the present wheat growing area, but on account of its low yield it is not worthy of a place in districts where Marquis matures.

Red Bobe—Medium in yield and high in quality, rather subject to rust. About four days earlier than Marquis but yields nearly four bushels less at Saskatoon. A promising variety for northern areas.

Kitchener—Similar to Marquis in yield and other important characters. The seed is larger than Marquis but the quality of flour is inferior, especially in color, and the crop is usually a day or so later in ripening.

Kubanka—High yield, rust resistant and drought resistant. Our best macaroni wheat. Recommended for trial in South-Western Saskatchewan.

OATS—Banner—High yield, strong straw, late in maturing, excellent quality—the old standard oat and a general favorite still.

Victory—High yield, strong straw, late in maturing, excellent quality. A keen rival of Banner.

Gold Rain—High yield, strong straw, medium early, excellent quality, yellow color—an excellent medium early variety.

Daubeney—Medium to low in yield, strong straw, early maturing, excellent quality. Only recommended for late seeding.

BARLEY—O A C No. 21—Six rowed bearded, hulled, very productive, medium early. The most popular six rowed sort.

Early Six—Six rowed, bearded, early and quite productive.

Hannchen—Two rowed, bearded, hulled, a "nodding" barley, very productive, slightly later than O A C 21. The heaviest yielding barley at Saskatoon. A good variety where long straw is desired and where a few days later in maturing is not an objection.

Canadian Thorpe—Two rowed, bearded, hulled, and "erect" barley, quite productive, later than O A C 21, stiffer in the straw than Hannchen, and a better-looking grain. Suited to heavier and richer soils.

SPRING RYE—Prolific.

WINTER RYE—N. D. No. 959 and Saskatchewan.

FLAX—Premont—Brown seeds, purple blossoms, productive, medium early.

PEAS—Arthur—A heavy yielding, medium early variety.

Golden Vine—A popular small seeded, medium early sort.

Early White.—Seeds smaller than Golden Vine, earlier and fairly productive.

Carlton.—High yield, medium early, medium sized pea with brownish spots. A promising variety.

Solo.—A heavy yielding, rather late sort.

THE VALUE OF THE FANNING MILL.

In a cleaning test recently completed the large plump seed removed by hand from a sample of No. 1 Northern produced 4 bushels 47 pounds more than the small shrunken grain the sample contained. The fanning mill could not make so good a separation and the average increase from cleaning was only 41 pounds over the uncleaned and 2 bushels, 26 pounds over the yield of the shrunken seeds.

A good fanning mill properly handled will, in addition, remove weed seeds, smut balls and many of the dead and weakened grains. In seasons when much of the grain is shrunken or frosted, and some of the seed damaged, impure, or dead, the use of the fanning mill is essential if the best results are to be obtained.

If we were to take half an hour and count out the weed seeds and diseased grains in a pound of the grain to be sown, and then take steps to improve our seed as much as the facilities at our disposal permit, there is little doubt but that such a half-hour would with most of us prove to be much more profitable than any ten that will later be spent in producing the crop.

Since the writing of this article was commenced a sample of "cleaned" wheat containing at the rate of 1,920 wild oats per bushel (16 per one-half pound) has come to hand with the request that we advise the sender whether he should get a new fanning mill or not. Another sample taken from a farmer's drill contained 7 smut balls, 226 wild buckwheat, 2 wild mustard, 2 ball mustard, 12 lamb's quarters, 1 blue burr, 2 docks, 1 hare's ear mustard, 1 barley and 8 oats in a single pound. Every bushel sown placed sixty times these numbers on the land. And yet practically all could have been removed with a fanning mill.

THE GERMINATION TEST.

It is important that the crop producer know not only the proportion of his seed that will grow, but also the vigor of the possible growth. Both the percentage and vigor of germination can be determined by giving a definite number of the grains opportunity to grow. A box of moist soil or two layers of dampened blotting paper will serve this purpose. It is only necessary to count out a number of seeds, usually one hundred, and after planting them in the soil or placing them between the blotters, keep them moist and at the temperature of the ordinary living room, and count the number that germinate on the fourth and each subsequent day.

From such a test one will gather an accurate idea of the percentage germination and the relative vigor of the growth from the seed he is about to use. The best seeds will germinate first and develop the most vigorous plants, while the poorer seeds will either not grow at all or produce only a feeble growth.

Of course the seed under test should be protected from frost and kept from drying out.

SEED TREATMENT FOR DISEASE.

The *Formalin treatment* when properly applied and used annually will control the covered smuts of wheat, oats and barley and the loose smut of oats, providing infection by spores from "smutty" bags or other containers after treating is prevented. It will also aid in the control of flax wilt.

Formalin is a trade name for a 40 per cent. solution of formaldehyde. One pound (16 ounces) or one pint of this solution well stirred in forty imperial gallons of water gives the proper strength for treating cereal grains. The seed may either be "dipped" in this solution, or it may be put in a pile on the floor and sprinkled with it.

Given the right strength of solution only two other things are essential to kill the spores; (1) the broken smut balls must be removed either by the fanning mill or by "floating" them off the surface of the liquid—the solution will not penetrate to the centre of an unbroken smut ball, hence this precaution must be taken to remove them—and (2) the entire surface of each seed must be moistened.

If the seed is "dipped" it should not be left in the solution for more than four

or five minutes before being removed and spread out dry. Open containers through which the liquid can run are preferable to bags for "cupping." With bags it is necessary to leave the grain in the solution for a longer period in order to insure the wetting of the grain in the centre of the bags, and no opportunity is afforded for skimming off the smut balls.

If the grain is "sprinkled" about one gallon per bushel should be used. As the solution is being applied, the grain should be shoveled or turned over and over in order to insure uniform and thorough moistening of the whole surface of each grain. After sprinkling with formalin the grain should be heaped up in a pile and covered with bags or blankets for about three hours, when it should be uncovered and spread out thinly to dry. For seed wheat containing numerous smut balls some method other than "sprinkling" should be used, which will allow of the removal of these at the same time the grain is being treated.



1 2 3 4
The formalin Treatment controls "Bunt," "Covered" or "Stinking Smut." Two sheaves on left from "treated" seed; two on right from "untreated" seed. (1) Proportion of diseased plants from treated seed; (5) Proportion of diseased plants from untreated seeds.

In treating flax, the sprinkling method should be used. A very fine spray is preferred, and the seed should be stirred continually as the liquid is applied. All other operations are similar to those followed in treating wheat with the exception that flax must be raked over occasionally as it dries in order to prevent the seed "caking" or clinging together in lumps and thus causing trouble in the drill.

The smut that occasionally occurs on rye can also be controlled with formalin. The treatment is the same as for wheat except that it has been found that covering the grain is unnecessary.

The Bluestone treatment will control the covered or stinking smut of wheat, but is not satisfactory for the smuts of other crops nor for flax wilt. If this treatment is to be used, five pounds of the commercial quality copper sulphate should be dissolved in fifty imperial gallons of water, by suspending it in a bag for a period of eight to twelve hours in a barrel of water. With bluestone, either "dipping" or "sprinkling" may be practised. The same care should be taken to remove smut balls and to insure the wetting of the whole surface of all seeds. If the seed is "dipped" it ought not to be left in the solution for more than two or three minutes.

Precautions necessary in using formalin and bluestone.—The strength of the solution used should be neither greater nor less than that given above. The seed should not be allowed to freeze hard while wet or the germination will be injured. Grain that has been treated with bluestone should be spread out in a thin layer to

dry immediately after the operation. If treated with formalin it should be covered for a period of three hours after treatment, and then permitted to dry as quickly as possible. If allowed to remain damp for too long a period the vigor and germination become impaired. Generally speaking, seed grain should not be treated very long before it is sown. In actual practice, treating the day before it is needed is the common rule; the longer it is left unsown after being treated, the less vigorous the germination. This is particularly true if bluestone is used. Every care should be exercised to see that "treated" grain is not reinfected by being handled in smut infected bags.

Wooden vessels are necessary if the bluestone treatment is used since the bluestone solution corrodes metal containers. The grain remains poisonous indefinitely after treatment with bluestone, whereas grain treated with formalin is harmless to animals as soon as it becomes perfectly dry.

Treating grain increases its bulk, and of course allowance for this should be made when sowing.

Smut Machines.—Many machines for the treatment of grain for disease are on the market. They are good insofar as they facilitate the speed of the operation, make possible the more efficient removal of smut balls and at the same time insure the wetting of the entire surface of each seed. The suitability and durability of the various makes are usually not difficult to estimate.

The Hot Water Treatment will control all the smut diseases of cereals, but is very laborious and time consuming. It is only advisable for the smuts the other treatments will not control, viz., the loose smuts of wheat and barley. In Bulletin No. 73 of the Division of Botany, Central Experimental Farm, Ottawa, the hot water treatment for the loose smuts of wheat and barley is outlined as follows:

"Preliminary Treatment—Bring the temperature of a quantity of cold water in a barrel or tank up to 86 F., pouring in hot water until the thermometer registers 86 F. and not more nor less. Use a reliable thermometer. Fill the grain bag three-quarters full with grain and tie it up loosely. Immerse bag with grain into this water, moving it up and down several times. Allow grain to soak four hours. Should the temperature sink below 68 F. allow five hours for soaking. Treat preferably in a heated room to avoid the inconvenient fall in temperature of the water.

"Final Treatment—Bring the temperature of water in a second barrel up to 112 F. Remove bags with grain from the "soak" and transfer to the second barrel. Keep immersed for 15 to 20 minutes. Meanwhile have water in a third barrel brought up to a temperature of 129 F. After the 15 to 20 minutes in the second barrel, transfer the grain quickly into the third barrel. Here the grain remains a further 10 minutes. Under no circumstances extend the time stated, or shorten it. Neither be careless nor disregard accuracy of temperatures, or the treatment will not be successful. Should the temperature in the third barrel sink below 122 F. after the grain is put in, raise the temperature by carefully adding hot water from a sprinkling can. Never pour hot water directly on the grain. The larger the volume of water the more easy it will be found to maintain the temperature. After the 10 minutes in the third barrel have expired, take out the grain, drain and spread out to dry."

DATES OF SEEDING.

Conclusive data on the subject of time of seeding in Saskatchewan are not yet available. The general opinion among experienced farmers is that wheat should be sown as soon after April 10 as the land is fit, and oats and barley in the three or four weeks following April 25. We have observed that on land that is in good condition the longer wheat is left unsown after the first of May, and oats and barley after the middle of May, the lighter the yield is likely to be. In the dates of seeding trials at Saskatoon carried on during the last three years, April 20 proved the best date for seeding wheat on fallow and April 30 on fall plowing. Oats, barley and flax produced the most when sown between April 20 and May 20. Winter Rye on fallow yielded most when sown the first few days of September and on fall plowing when sown August 20. April 30 with peas proved the best time to sow.

The best time to sow in any given district varies with:

(1) The probability of early fall frosts—the greater the danger the earlier the seeding should be done.

(3) The amount of water stored in the soil—the drier the soil the earlier the crop will mature and, therefore, the later it may be sown and yet avoid frost.

(3) The productiveness of the soil—the more rank the growth, the longer the crop will take to ripen, hence the earlier it should be sown.

(4) The type of soil—a heavy soil is a cold soil, a lig it soil is a warm one. Crops ripen later on heavy soils and, therefore, need to be sown earlier.

THE TIME TO SOW

INFLUENCE of DATE of SEEDING MARQUIS WHEAT			
		Breaking	
		Acre Yield	Acre Profit
Apr. 10		37 bu. 25 lb.	6.46
Apr. 20		35 bu.	6.47
Apr. 30		37 bu. 10 lb.	6.05
May 10		35 bu. 4 lb.	6.61
May 20		31 bu. 43 lb.	3.66
		Shubble	
		Acre Yield	Acre Profit
Apr. 10		25 bu. 22 lb.	5.38
Apr. 20		26 bu. 10 lb.	5.79
Apr. 30		26 bu. 35 lb.	6.02
May 10		24 bu. 28 lb.	4.76
May 20		23 bu. 50 lb.	3.65

Average 3 years 1914-15-16.

(5) The time required to mature the class or variety or crop used. Under the different conditions that exist in this province, six-rowed barley, spring rye and flax ripen in from 75 to 110 days; two-rowed barley in 85 to 115 days; oats (standard varieties) 90 to 120 days; wheat 90 to 140, and peas 95 to 140. Obviously the late ripening crops should be sown first unless they are too tender to resist spring frosts.

(6) The resistance of the crop to spring frosts. The less frost in spring a crop will stand the later it should be sown. If good seed is used, most cereals will survive after heavy spring frosts, but it has been observed that wheat and rye are rather more resistant to low temperatures than oats or barley.

(7) The liability of the district to hot winds in late summer—the greater the danger, the sooner the crop should be sown.

Influence of the Time of Seeding on the Date of Maturity of Marquis Wheat

ON BREAKING			ON FALL FLOWING		
DATE SHOWN	NO. OF DAYS MATURING	DATE RIPE	NO. OF DAYS MATURING	DATE RIPE	
APR 10		124 AUG. 12		119 AUG. 7	
APR 20		117 AUG. 5		111 AUG. 9	
APR 30		110 AUG. 8		103 AUG. 12	
MAY 10		101 AUG. 19		95 AUG. 14	
MAY 20		92 AUG. 30		85 AUG. 16	

Early seeding is desirable (1) in all areas subject to early fall frosts, (2) on fallowed land, (3) on rich productive and heavy soils and (4) with all late maturing crops. Later seeding is permissible (1) in areas where fall frosts seldom do damage to the crops, (2) on light warm soils, (3) on fall or spring plowed or stubble fields containing little moisture and (4) with all early maturing crops.

RATES OF SEEDING.

The normal amounts of seed used on medium soil types in Central Saskatchewan are for wheat, $1\frac{1}{2}$ to $1\frac{3}{4}$ bushels per acre; oats, 2 to 3 bushels; barley, $1\frac{1}{2}$ to $2\frac{1}{4}$ bushels; winter rye, $\frac{3}{4}$ to $1\frac{1}{4}$ bushels; flax, 25 to 35 pounds, and peas, 2 to 3 bushels.

The amounts used in different parts of the province vary, with wheat from $\frac{3}{4}$ bushels to 3 bushels; oats from 1 to 5; barley from 1 to 3; winter rye, $\frac{1}{2}$ to $1\frac{1}{4}$; flax, from 20 to 50 pounds, and peas, $1\frac{1}{4}$ to $3\frac{1}{2}$ per acre.

THE AMOUNT TO SOW

The influence of the rate of seeding on the Acre Yield and Relative Acre Profit
—Marquis Wheat.

ACRE RATE OF SEEDING	ACRE YIELD	RELATIVE ACRE PROFIT
1 bu.	34 bu. 40 lb.	7.77
$1\frac{1}{4}$ bu.	34 bu. 30 lb.	7.41
$1\frac{1}{2}$ bu.	34 bu. 35 lb.	6.30
2 bu.	34 bu. 45 lb.	6.15
$2\frac{1}{2}$ bu.	35 bu. 46 lb.	5.20

ON FALL FLOWING.		
1 bu.	24 bu. 56 lb.	4.78
$1\frac{1}{4}$ bu.	25 bu. 18 lb.	4.46
$1\frac{1}{2}$ bu.	24 bu. 63 lb.	4.08
2 bu.	24 bu. 56 lb.	3.88
$2\frac{1}{2}$ bu.	23 bu. 26 lb.	2.65

As little as $\frac{1}{2}$ bushel of wheat and 1 bushel of oats are reported to have given good returns on light soils in Southwestern Saskatchewan in a dry year, while as much as $2\frac{1}{2}$ bushels of wheat and 5 bushels of oats are sometimes used on fallowed land on the heavy, rich soils of Northern Alberta and Saskatchewan.

The rates that have given the largest returns in our rates of seeding trials on fallow are: Wheat, $1\frac{1}{2}$ bus.; oats, 3 bus.; six rowed barley, $1\frac{1}{4}$ bus.; winter rye, $\frac{3}{4}$ bus., flax, 20 to 28 pounds, and peas, $2\frac{1}{2}$ bus.

In a dry season at Saskatoon 20 pounds of flax, $\frac{1}{2}$ bushel of winter rye, and $\frac{1}{2}$ bushel of wheat each produced a larger yield than any thicker seeding, but in a "wet" year when the frost came early in the fall our largest yields of wheat and oats were secured when $2\frac{1}{2}$ bushels and 4 bushels respectively were used.

The amount of seed that should be used under any given set of conditions varies with:

- (1) The kind of soil, whether heavy or light.
- (2) The preparation, whether fallow, breaking of stubble.
- (3) The time of seeding, whether early or late.
- (4) The danger of fall frosts.
- (5) The proportion of the seed that will grow.
- (6) The number of seeds in a bushel.

Relatively larger quantities should be used (1) on heavy soils, (2) on fields such as the fallow which contains a good store of moisture, (3) in all areas subject to

early fall frosts, and (4) when the seeds are about the normal size and, therefore, relatively few per bushel. If the percentage germination is low, heavier seeding should be practised.

Smaller quantities may be used (1) in dry areas, (2) on light soils, (3) on stubble

The influence of the Rate of Seeding on the Acre Yield and Relative Acre Profit in the early fall frost season of 1911 and the dry season of 1914—Marquis Wheat.

IN 1911—AN EARLY FALL FROST YEAR

ACRE RATE OF SEEDING	ACRE YIELD	RELATIVE ACRE PROFIT
$\frac{1}{2}$ bu.	15 bu. 4 lb.	2.10 bu.
1 bu.	24 bu. 6 lb.	1.91
$1\frac{1}{2}$ bu.	29 bu. 4 lb.	4.01
$1\frac{3}{4}$ bu.	30 bu. 8 lb.	4.35
2 bu.	34 bu. 12 lb.	4.65
$2\frac{1}{4}$ bu.	34 bu. 0 lb.	4.65

IN 1914—A VERY DRY YEAR

1 bu.	23 bu. 44 lb.	1.72
$1\frac{1}{2}$ bu.	25 bu. 40 lb.	1.25
$1\frac{3}{4}$ bu.	25 bu. 15 lb.	79¢
2 bu.	25 bu. 52 lb.	72¢
$2\frac{1}{4}$ bu.	22 bu. 40 lb.	18¢ Loss

fields which contain but a limited supply of water, (4) where there is no danger of fall frosts and (5) when the seeds are small in size but normally developed. Thinly seeded fields withstand the most drought, but thickly seeded ones mature earlier.

DEPTH OF SEEDING.

Wheat, oats, barley, rye and peas are usually sown from one and one-half to three inches in depth and flax a little shallower; but the depth should vary with:

- (1) The depth at which firm, moist soil is found.
- (2) The kind of soil.
- (3) The time of seeding.

In order to grow, seeds must have heat, air and moisture. The place in the soil where optimum amounts of all these can be obtained is generally the best depth to sow. In this country, moisture is the most important of these factors and, therefore, generally controls the depth to which seeds should be placed.

Very often the soil is not properly prepared and as a result the surface is dry to a considerable depth. Under these conditions the best depth to sow cannot be foretold. In loose soil the seed should be sown deeper than in firm soil. On fall or spring plowed land it should be sown deeper than on fallowed land and on light land deeper than on heavy land. Early seeding should generally not be done as deeply as later seeding. On stubble fields a common fault is too shallow seeding.

"Sow into the moisture" is a good motto if the soil has been managed in such a way as to have the moisture within 1 to 3 or 4 inches from the surface.



